SMART Ground-Based Remote Sensing at Dun-Huang during ACE-Asia

Si-Chee Tsay, Q. Jack Ji, D. Allen Chu, Eric G. Moody, Brent N. Holben, E. Judd Welton, and Michael D. King - NASA Goddard Space Flight Center, USA
Zhibao Shen, Hau Jiang, and Guang-Yu Shi - Chinese Academy of Sciences, China
Jeffery S. Reid – SPAWAR System Center San Diego, USA
Wanfu Wang - Conservation Institute of the Dunhuang Academy, China

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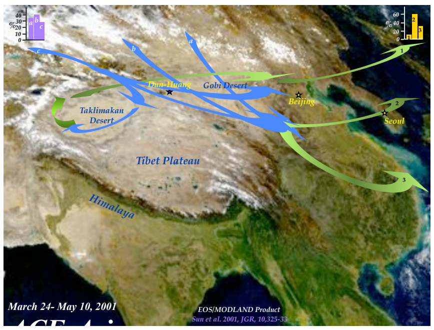
❑ Background

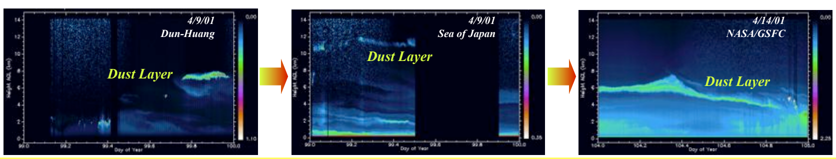


Dun-Huang (40 °N, 95 °E) is located at one of the largest oases between the Taklimakan and the Gobi deserts. It is in the source region of dust storms without much anthropogenic contamination.

Dust storm is approaching the Dun-Huang site and the researchers have scrambled for shelter, photo taken on April 28, 2001.

The fierce storm has generated a dense blanket of dust in the air, just one hour after the event.

Based on analyses of the past 40 years meteorological data, Sun *et al*. (2001) concluded that dust storms originating in China are highly associated with the frontal systems and the Mongolian cyclonic depression. Dust aerosols entrained from the Gobi desert and its vicinity can commonly be elevated up to 3 km to produce regional impact, whereas dust materials from the Taklimakan desert can frequently be entrained to an elevation higher than 5 km and transported over long distances (e.g., ~5,000 km) by the westerlies (*cf*. below, lidar backscatter signal for vertical structure).

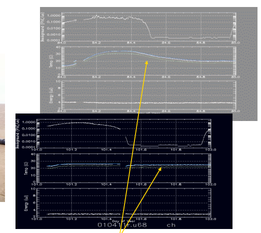


❑ Quality Control/Assurance

Daily instrument maintenance was actively performed by local personnel.

Radiometric calibration of the shadowband radiometer was routinely determined from a LiCor calibrator.

Horizontal measurements were acquired typically in the field for Micropulse Lidar data correction of after-pulse and overlapping effects.



Initially, the temperature fluctuated between 12 and 35 °C in the hut, until stabilization was achieved through efforts to obtain and install a heat pump.

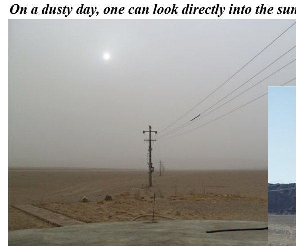
❑ Instrumentation and Deployment

SMART: Surface Measurements for Atmospheric Radiative Transfer

- Sun Photometers (Cimel, MFR, S^3) - - - - - - - - - direct and diffuse solar radiation at discrete spectral wavelengths
- Total Sky Imager (TSI) - - - - - - - - - - - - - - - - - monitoring and documenting sky conditions every minute
- Micro Pulse Lidar (MPL) - - - - - - - - - - - - - - - - profiling vertical structure of aerosol and cloud layer
- Broadband Radiometers (PSP, NIP, PIR, etc.) - - hemispherical irradiance of solar and terrestrial radiation
- Spectrometers (ASD) - - - - - - - - - - - - - - - - - - - transmitted and reflected solar spectrum (0.35 ~ 2.5 µm)
- Scanning Microwave Radiometer (SMiR) - - - - - atmospheric precipitable/liquid water and surface brightness temperature
- Particle Sizer (APS) - aerosol size distribution (0.5 ~ 15 µm in diameter)
- Nephelometer - backscattering coefficients at red, green, and blue wavelengths
- Aerosol sampler - aerosol chemical compositions
- Meteorological Sensors - - - - - - - - - - - - - - - - - pressure, air temperature, relative humidity, wind direction and speed
- Guest instruments - collocated measurements for other research groups

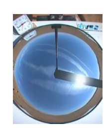
Dusty vs. Clean

On a dusty day, one can look directly into the sun.



On a clear day, visibility is over 100 km.

Total Sky Imager captures a dust storm passing through the Dun-Huang site.



Contrails streak across a clear blue sky.